ifm electronic

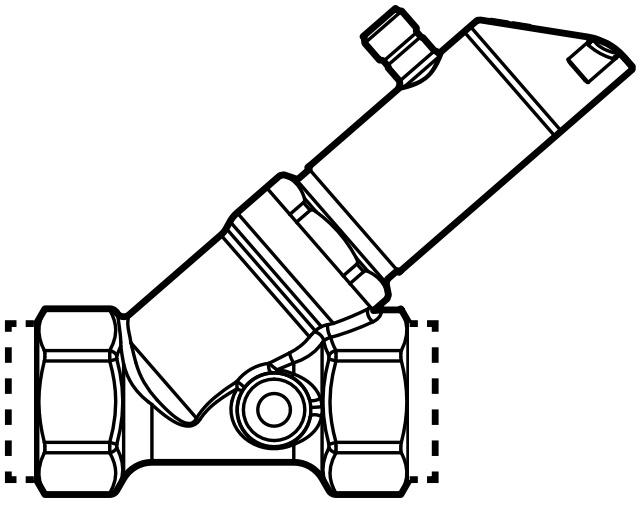
CE

Operating instructions
Mechatronic flow sensor

efector300

UK

SBY2xx
SBG2xx
SBN2xx



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1 Preliminary note

1.1 Symbols used

▶ Instructions

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information_Supplementary note.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- The responsibility whether the measurement devices are suitable for the respective application lies with the operator. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the units result in a loss of the warranty claims.
- During installation or in case of a fault (housing damage) media under high pressure or hot media can leak from the system.
  ▶ Install the unit according to the applicable rules and regulations.
  ▶ Ensure that the system is free of pressure during installation.
  ▶ Ensure that no media can leak at the mounting location during installation.

▶ Equip the unit with suitable protection (e.g. cover) to avoid hazard to personnel from leaking media.

3 Functions and features

The unit monitors liquid media (water, glycol solutions, industrial oils, coolants).

It detects the two process categories volumetric flow or medium temperature.

4 Function

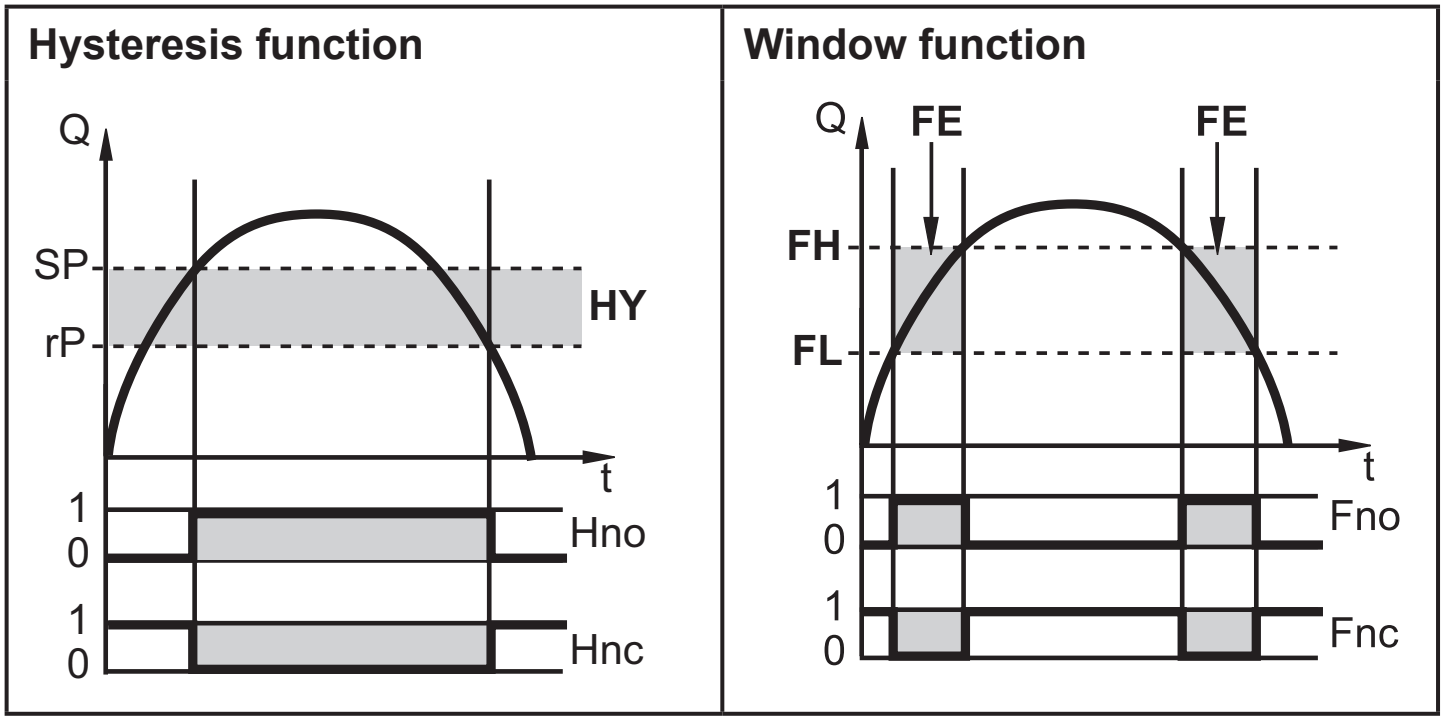
- The unit detects the volumetric flow quantity based on the principle of differential pressure.
- The unit features an IO-Link interface and is designed for full bidirectional communication.
- The unit displays the current volumetric flow quantity or temperature. It generates 2 output signals according to the parameter setting:

OUT1/IO-Link: 4 selection options	Parameter setting
- Switching signal: limit values for volumetric flow quantity	→ 9.2.1; → 9.2.2
- or switching signal: limit values for temperature	→ 9.3.1; → 9.3.2
- or frequency signal for volumetric flow quantity	→ 9.2.4
- or frequency signal for temperature	→ 9.3.4

OUT2: 2 selection options	Parameter setting
- Analogue signal for volumetric flow quantity	→ 9.2.3
- or analogue signal for temperature	→ 9.3.3

4.1 Switching function

OUT1 changes its switching status if it is above or below the set switching limits (flow or temperature). Hysteresis or window function can be selected. Example of volumetric flow monitoring:



SP = set point
rP = reset point
HY = hysteresis
Hno / Fno = NO (normally open)

FH = upper limit value
FL = lower limit value
FE = window
Hnc / Fnc = NC (normally closed)

When the hysteresis function is set, the set point (SPx) is defined first and then the reset point (rPx) which must be of a lower value. If only the set point is changed, the reset point remains constant.

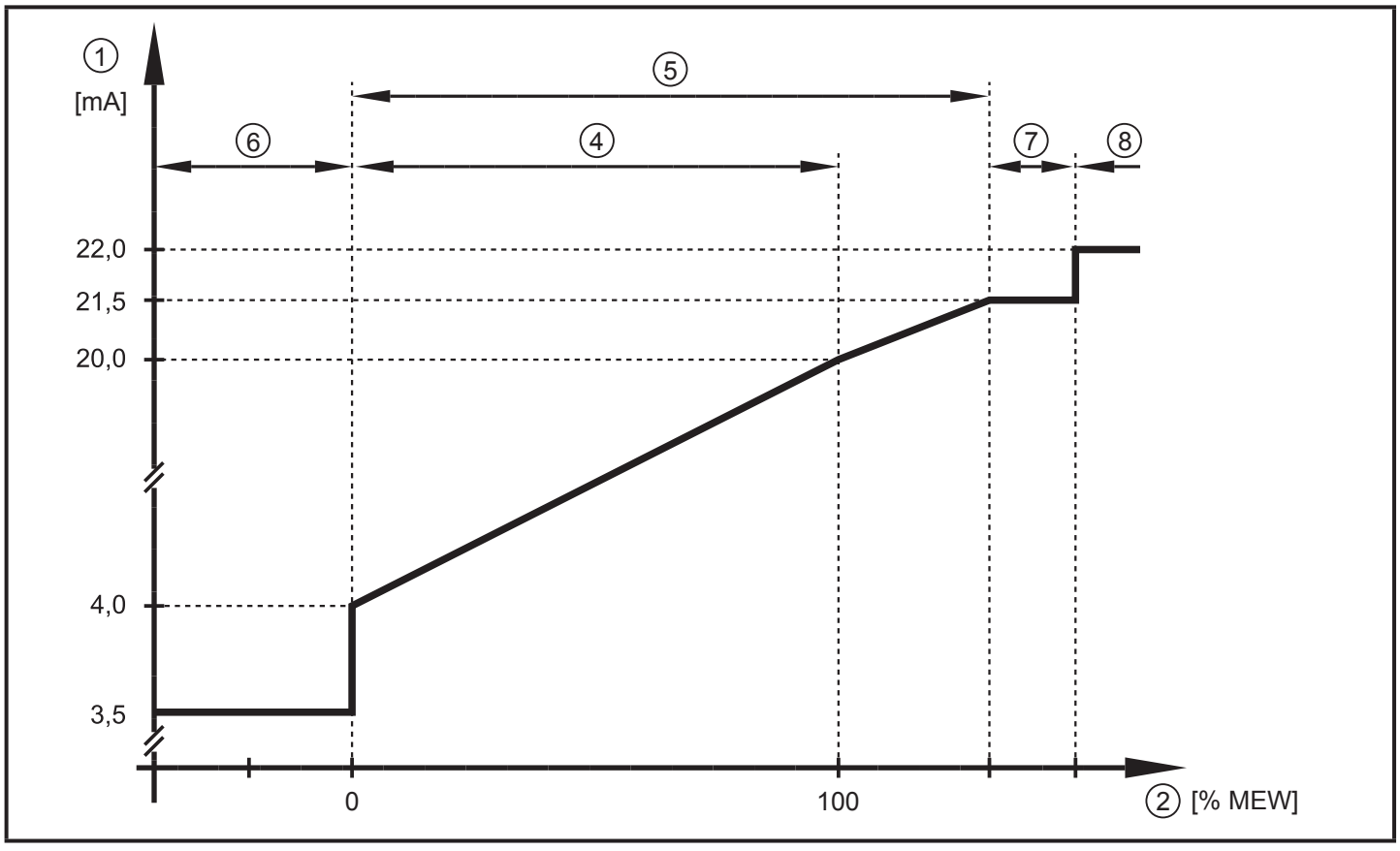
When set to the window function the set and reset points have a fixed hysteresis of 0.25 % of the final value of the measuring range. This keeps the switching status of the output stable if the volumetric flow varies slightly.

4.2 Analogue function

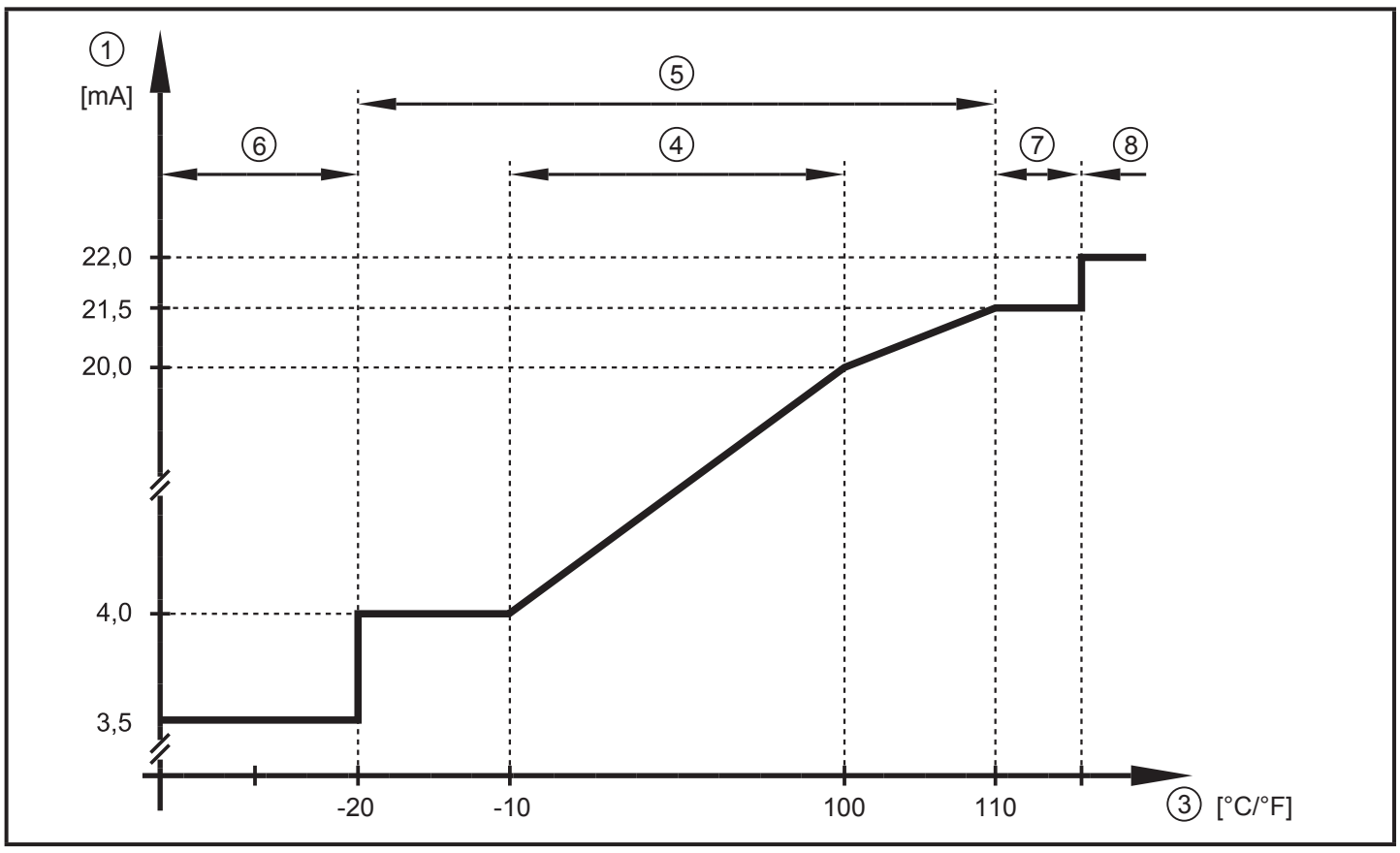
The unit provides an analogue current signal that is proportional to the volumetric flow quantity and the medium temperature. Within the measuring range the output signal is between 4 and 20 mA. Outside the measured and displayed value range or in case of a fault the signals < 4 mA or > 20 mA are provided (→ Figures).

Caption:
1: Output current in mA
2: Volumetric flow quantity (final value of the measuring range MEW = 100 %)
3: Medium temperature
4: Measuring range
5: Display range
6: The unit is in the error state (FOU = OFF)
7: The process value transmitted in an analogue way is therefore above the display range
8: The unit is in the error state (FOU = ON)

A. Volumetric flow monitoring:



B: Temperature monitoring:



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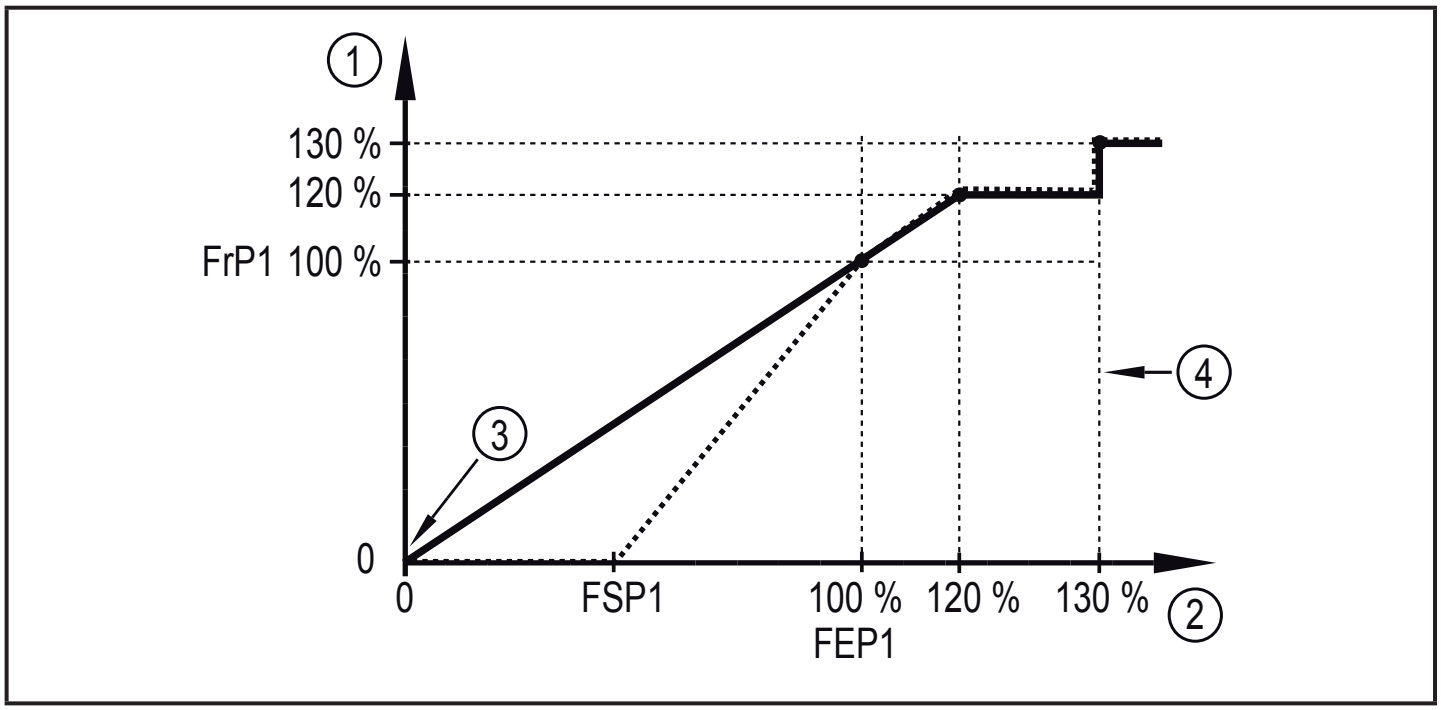
4.3 Frequency output

The unit provides a frequency signal that is proportional to the volumetric flow quantity and the medium temperature.

Up to the limit value set under [FEP1] (for OUT1 = TEMP: between the limit values set under [FSP1] and [FEP1]) the frequency signal is between 0 Hz and the frequency value set under [FrP1].



1: Frequency signal in Hz
2: Volumetric flow quantity or temperature
3: The device is in the error state (FOU = OFF) or the process value transmitted in an analogue way is below the display range or the current flow is 0.
4: The unit is in the error state (FOU = ON)

4.4 IO-Link

4.4.1 General information

This unit has an IO-Link communication interface which requires an IO-Link-capable module (IO-Link master) for operation.

The IO-Link interface enables direct access to the process and diagnostic data and provides the possibility to set the parameters of the unit during operation.

In addition communication is possible via a point-to-point connection with a USB adapter cable.

You will find more detailed information about IO-Link at www.ifm.com/gb/io-link.

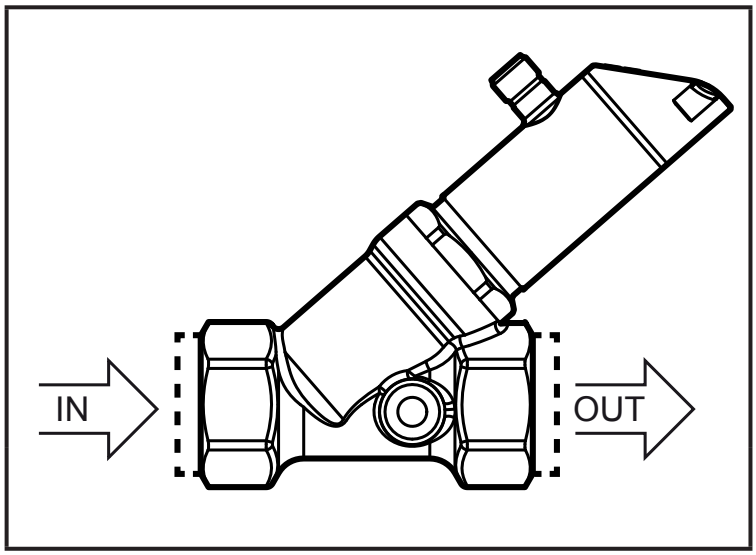
4.4.2 Device-specific information

You will find the IODDs necessary for the configuration of the IO-Link unit and detailed information about process data structure, diagnostic information and parameter addresses at www.ifm.com/gb/io-link.

4.4.3 Parameter setting tools

You will find all necessary information about the required IO-Link hardware and software at www.ifm.com/gb/io-link.

5 Installation



▶ Insert the unit into the pipe according to the direction of flow (arrow) and tighten.

With water containing dirt:

▶ horizontal installation recommended.

IN = inlet
OUT = outlet

Baffled pipes on the sensor's inlet or outlet side are not necessary.

The sensor has the function of a non-return valve.

The sensor head can be rotated by 360°.

▶ Do not install the unit on ferromagnetic materials.
(Ferromagnetic materials are all metals exerting an attractive force on test magnets.)

▶ Do not operate the unit in the vicinity of magnetic constant and alternating fields (e.g. welding systems).

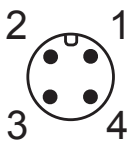
▶ If the sensors are installed side by side, observe a minimum distance of 50 mm between the sensor axes.

6 Electrical connection

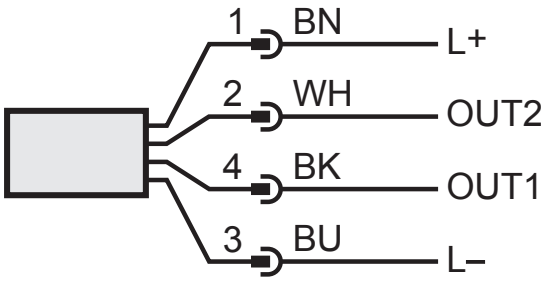
The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:



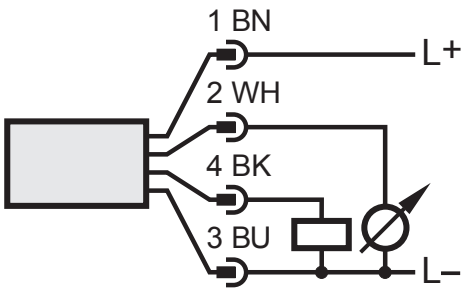
BK: black
BN: brown
BU: blue
WH: white



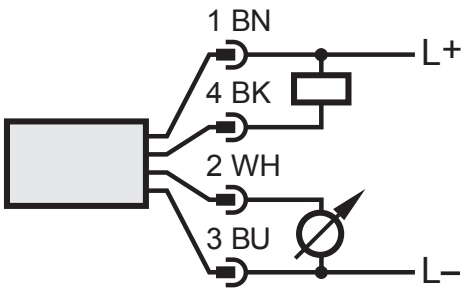
Colours to DIN EN 60947-5-2

Sample circuits:

1 x positive switching / 1 x analogue

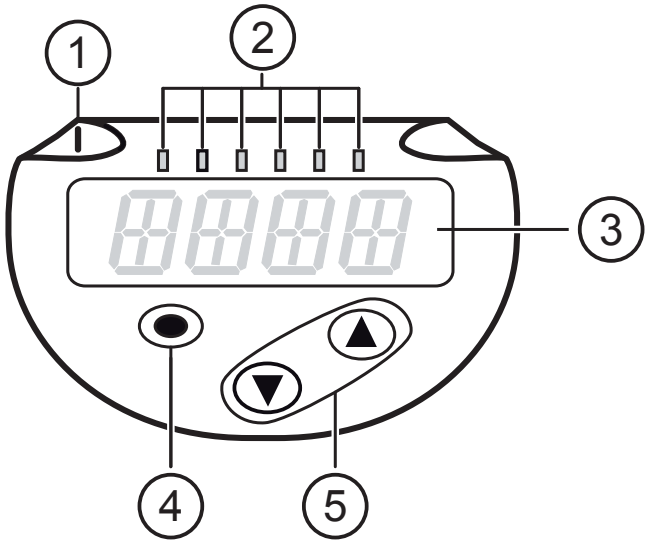


1 x negative switching / 1 x analogue



Pin 1	L+
Pin 3	L-
Pin 4 (OUT1)	• Switching signal: limit values for volumetric flow quantity • Switching signal: limit values for temperature • Frequency signal for volumetric flow quantity • Frequency signal for temperature • IO-Link
Pin 2 (OUT2)	• Analogue signal for volumetric flow quantity • Analogue signal for temperature

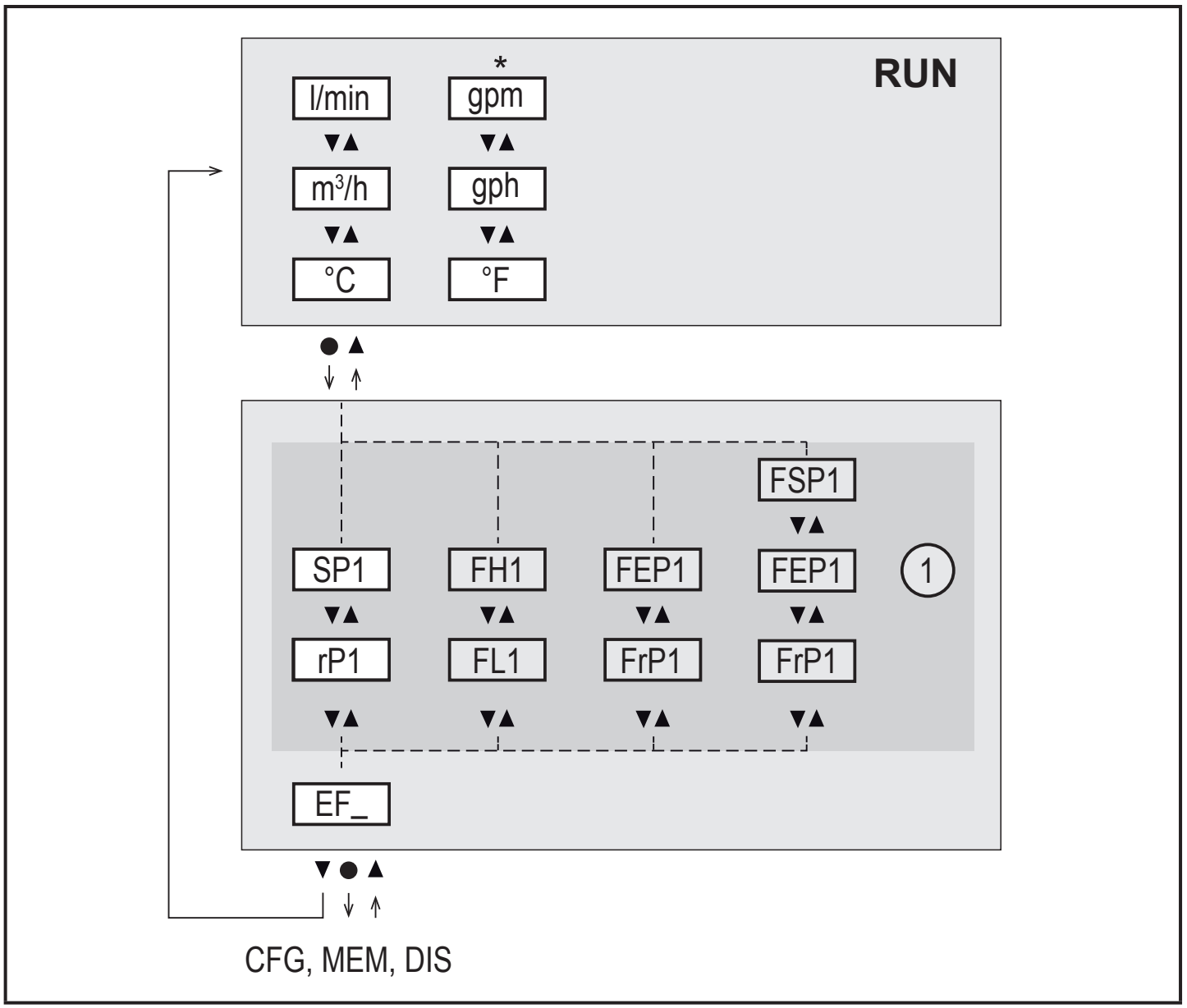
7 Operating and display elements



1, 2: Indicator LEDs
• LED 1 = switching status OUT1 (lights if output 1 is switched) • LEDs 2 = flow or temperature in the indicated unit of measurement
3: Alphanumeric display, 4 digits
• Display of current process values (volumetric flow quantity, temperature) • Display of the parameters and parameter values.
4: Button [●] = Enter
• Change from the RUN mode to the main menu • Change to the setting mode • Acknowledge the set parameter value
5: Buttons up [▲] and down [▼]
• Select parameters • Change parameter values (hold button pressed) • Change of the display unit in the normal operating mode (Run mode) • Locking / Unlocking (press buttons simultaneously > 10 seconds)

8 Menu

8.1 Process value display (RUN) and main menu



* For SBN2xx units: gpm, gph,°F

1: Output functions for ou1 (→ 8.2.1)

The parameters are only displayed when selected at ou1.

8.1.1 Explanation main menu

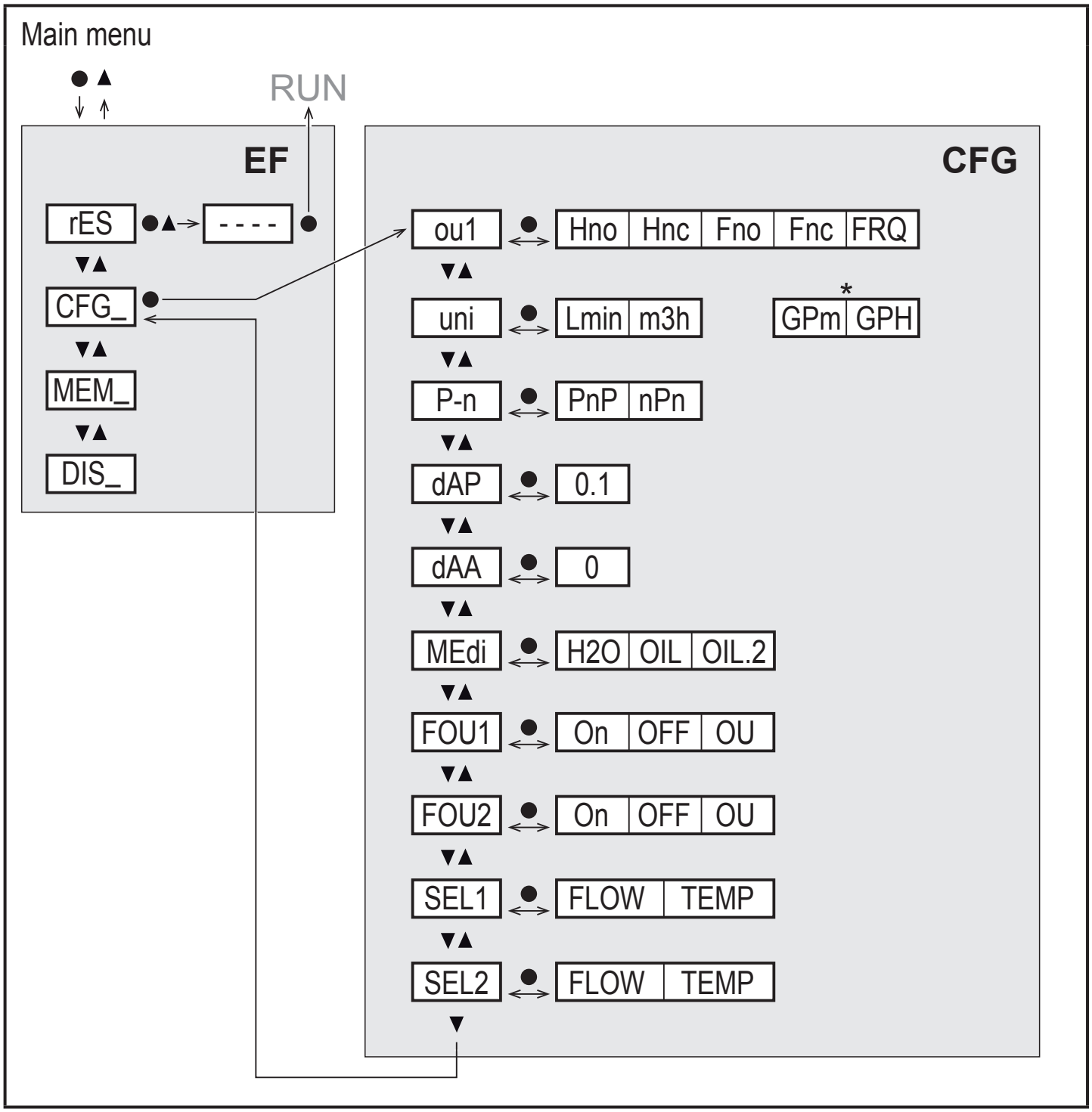
Switching output with hysteresis function	
SP1	Set point 1 = upper limit value at which OUT1 switches
rP1	Reset point 1 = lower limit value at which OUT1 is reset

Switching output with window function	
FH1	Set point 1 = upper limit value at which OUT1 switches
FL1	Reset point 1 = lower limit value at which OUT1 switches

Frequency output	
FSP1	Process value start point on OUT1 (only if SEL1 = TEMP)
FEP1	Process value end point on OUT1
FrP1	Frequency at process value end point on OUT1

Extended functions	
EF_	Opening of the lower menu level

8.2 Extended functions – Basic settings



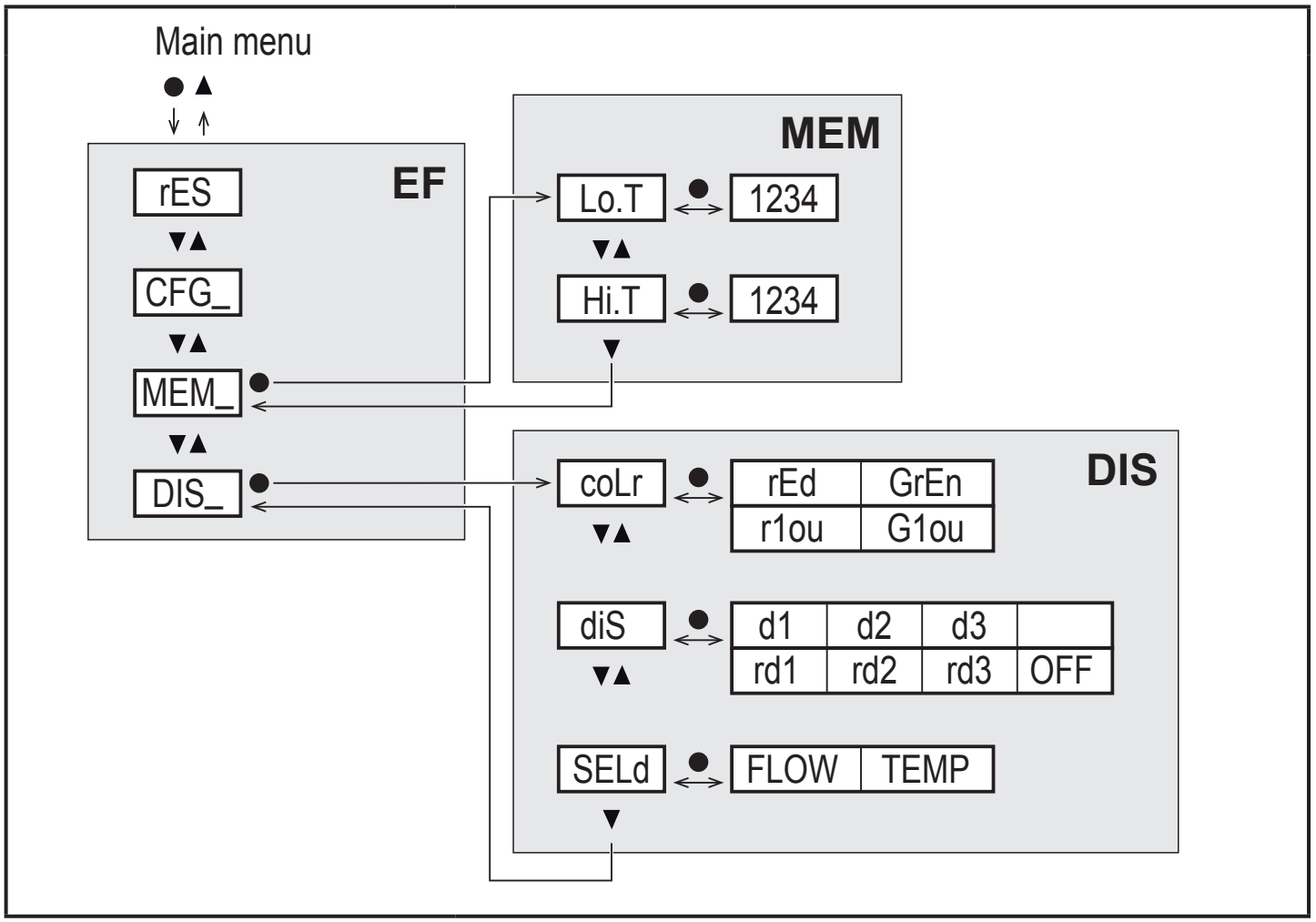
* For SBN2xx units: gpm, gph

rES	Restoring the factory settings
CFG_	Submenu basic settings
MEM_	Submenu min/max memory
DIS_	Submenu display settings

8.2.1 Explanation basic settings (CFG)

ou1	Output function OUT1 • Flow and temperature: Hno, Hnc, Fno, Fnc, FRQ
Hno	Hysteresis normally open
Hnc	Hysteresis normally closed
Fno	Window normally open
Fnc	Window normally closed
FRQ	Frequency output
uni	Standard unit of measurement for volumetric flow
P-n	Output logic: pnp / npn
dAP	Measured value damping for switching output in seconds
dAA	Measured value damping for analogue output in seconds
MEDI	Medium selection for volumetric flow
FOU1	Behaviour of output OUT1 in case of an error
FOU2	Behaviour of output OUT2 in case of an error
SEL1	Standard unit of measurement for evaluation by OUT1: volumetric flow value or medium temperature
SEL2	Standard measured variable for evaluation by OUT2: volumetric flow value or medium temperature

8.3 Extended functions – Min/max memory – Display



8.3.1 Explanation min/max memory (MEM)

Lo.T	Min. value of the temperature measured in the process
Hi.T	Max. value of the temperature measured in the process

8.3.2 Explanation display settings (DIS)

coLr	Assignment of the display colours red and green within the measuring range
rEd	Display always red
GrEn	Display always green
r1ou	Display red in case of switched output OUT1
G1ou	Display green in case of switched output OUT1
diS	Update rate and orientation of the display
SELd	Standard measuring unit of the display: volumetric flow value or medium temperature

9 Parameter setting

Parameters can be set before installation and set-up of the unit or during operation.

If you change parameters during operation, this will influence the function of the plant.

▶ Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.

The parameters can also be set via the IO-Link interface (→ 4.4).

9.1 Parameter setting in general

1. Change from the RUN mode to the main menu	[●]
2. Select the requested parameter	[▲] or [▼]
3. Change to the setting mode	[●]
4. Modification of the parameter value	[▲] or [▼] > 1 s
5. Acknowledge the set parameter value	[●]
6. Return to the RUN mode	→ 9.1.3

If [C.Loc] is displayed when attempting to change a parameter value, a change is made via a parameter setting software at the same time (temporary locking).

If [S.Loc] is displayed, the sensor is permanently locked via software. This locking can only be removed with a parameter setting software.

9.1.1 Select submenu

▶ Click [▲] or [▼] to select submenu (EF, CFG, MEM, DIS).

▶ Briefly press [●] to change to the submenu.

9.1.2 Exit parameter setting or menu level

▶ Press [▲] + [▼] simultaneously.

> Return to the next higher menu level. The changed parameter settings are not accepted.

9.1.3 Change to the process value display (RUN mode)

There are 3 possibilities:

1. Wait for 30 seconds (→ 9.1.5 Timeout).
2. Change from the submenu to the main menu, from the main menu to the process value display with [▲] or [▼].
3. Press [▲] + [▼] simultaneously until the RUN mode is reached.

9.1.4 Locking / Unlocking

The unit can be locked electronically to prevent unintentional settings. On delivery: not locked.

Locking:

► Make sure that the unit is in the normal operating mode.

► Press [▲] and [▼] simultaneously for 10 s until [Loc] is displayed.

During operation: [LOC] is briefly displayed if you try to change parameter values.

Unlocking:

► Make sure that the unit is in the normal operating mode.

► Press [▲] and [▼] simultaneously for 10 s until [uLoc] is displayed.

9.1.5 Timeout

If no button is pressed for 30 s during parameter setting, the unit returns to the operating mode with unchanged values.

9.2 Settings for consumed quantity monitoring

9.2.1 Limit value monitoring with OUT1 / hysteresis function

► Select [SEL1] and set [FLOW]. ► Select [ou1] and set the switching function: - [Hno] = hysteresis function/normally open - [Hnc] = hysteresis function/normally closed ► Select [SP1] and set the value at which the output is set. ► Select [rP1] and set the value at which the output is reset.	Menu CFG: [SEL1] [ou1] Main menu: [SP1] [rP1]

9.2.2 Limit value monitoring with OUT1 / window function

▶ Select [SEL1] and set [FLOW]. ▶ Select [ou1] and set the switching function: - [Fno] = window function/normally open - [Fnc] = window function/normally closed ▶ Select [FH1] and set the value at which the output switches. ▶ Select [FL1] and set the value at which the output is reset.	Menu CFG: [SEL1] [ou1] Main menu: [FH1] [FL1]

9.2.3 Configure the analogue output for volumetric flow

▶ Select [SEL2] and set [FLOW].	Menu CFG: [SEL2]

9.2.4 Configure the frequency signal for volumetric flow

▶ Select [SEL1] and set [FLOW]. ▶ Select [ou1] and set [FRQ]. ▶ Select [FEP1] and set the flow value at which the frequency set in FrP1 is provided. ▶ Select [FrP1] and set the frequency: 0.01 kHz...10 kHz.	Menu CFG: [SEL1] [ou1] Main menu: [FEP1] [FrP1]

9.3 Settings for temperature monitoring

9.3.1 Limit value monitoring with OUT1 / hysteresis function

▶ Select [SEL1] and set [TEMP]. ▶ Select [ou1] and set the switching function: - [Hno] = hysteresis function/normally open - [Hnc] = hysteresis function/normally closed ▶ Select [SP1] and set the value at which the output is set. ▶ Select [rP1] and set the value at which the output is reset.	Menu CFG: [SEL1] [ou1] Main menu: [SP1] [rP1]

9.3.2 Limit value monitoring with OUT1 / window function

▶ Select [SEL1] and set [TEMP]. ▶ Select [ou1] and set the switching function: - [Fno] = window function/normally open - [Fnc] = window function/normally closed ▶ Select [FH1] and set the value at which the output switches. ▶ Select [FL1] and set the value at which the output is reset.	Menu CFG: [SEL1] [ou1] Main menu: [FH1] [FL1]

9.3.3 Configure the analogue output for temperature

▶ Select [SEL2] and set [TEMP].	Menu CFG: [SEL2]

9.3.4 Configure the frequency signal for temperature

▶ Select [SEL1] and set [TEMP]. ▶ Select [ou1] and set [FRQ]. ▶ Select [FSP1] and set the lower temperature value at which 0 Hz is provided. ▶ Select [FEP1] and set the temperature value at which the frequency set in FrP1 is provided. ▶ Select [FrP1] and set the frequency: 0.01 kHz...10 kHz.	Menu CFG: [SEL1] [ou1] Main menu: [FSP1] [FEP1] [FrP1]

9.4 User settings (optional)

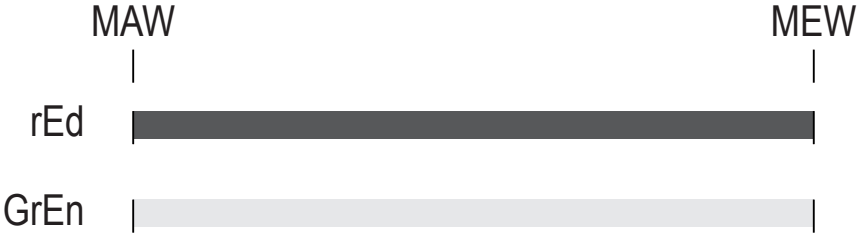
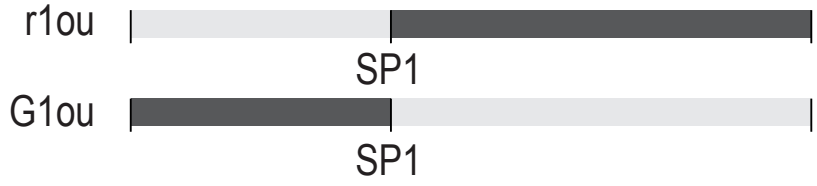
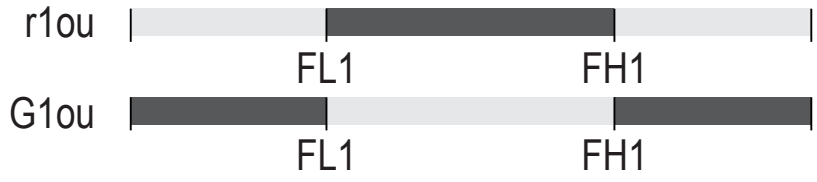
9.4.1 Set the standard unit of measurement for volumetric flow

▶ Select [uni] and set the unit of measurement: l/min, m^3/h (SBN2xx: gpm, gph). The selectable units of measurement depend on the respective unit.	Menu CFG: [uni]

9.4.2 Configuration of the standard display

▶ Select [SELd] and determine the standard measuring unit: - [FLOW] = the current volumetric flow value in the standard unit of measurement is displayed. - [TEMP] = the current medium temperature in °C is displayed (SBN2xx: °F). ▶ Select [diS] and set the update rate and orientation of the display: - [d1]: update of the measured values every 50 ms. - [d2]: update of the measured values every 200 ms. - [d3]: update of the measured values every 600 ms. - [rd1], [rd2], [rd3]: display as for d1, d2, d3; rotated by 180°. - [OFF] = The measured value display is deactivated in the Run mode. The LEDs remain active even if the display is deactivated. Error messages are displayed even if the display is deactivated.	Menu DIS: [SELd] [diS]

9.4.3 Configure colour change display

▶ Select [coLr] and define the colour of the process value display: rEd, GrEn, r1ou, G1ou. 1. Fixed colour setting:  2. Switching output OUT1 with hysteresis function:  3. Switching output OUT1 with window function:  MAW = initial value of the measuring range MEW = final value of the measuring range Red Green	Menu DIS: [coLr]

9.4.4 Set the damping for the switching output

▶ Select [dAP] and set the damping constant in seconds (τ value. 63 %); setting range 0...5 s.	Menu CFG: [dAP]

9.4.5 Set damping for the analogue output

▶ [Select [dAA] and set a damping constant in seconds. setting range 0...5 s.	Menu CFG: [dAA]

9.4.6 Set output status in fault condition

▶ Select [FOU1] and set the value: 1. Switching output: - [On] = output 1 switches ON in case of an error. - [OFF] = output 1 switches OFF in case of an error. - [OU] = output 1 switches irrespective of the fault as defined with the parameters. 2. Frequency output: - [On] = 130 % of FrP1. - [OFF] = 0 Hz - [ou1] = frequency signal is provided without any changes. ▶ Select [FOU2] and set the value: - [On] = output 2 switches ON in case of an error, the analogue signal goes to the upper error value. - [OFF] = output 2 switches OFF in case of an error, the analogue signal goes to the lower error value. - [ou] = output 2 switches irrespective of the fault as defined with the parameters. The analogue signal corresponds to the measured value.	Menu CFG: [FOU1] [FOU2]

9.5 Service functions

9.5.1 Read the min/max values for the temperature

▶ Select [Hi.T] or [Lo.T] and read the value. [HI.T] = max. value, [LO.T] = min. value. Delete memory: ▶ Select [Hi.T] or [Lo.T]. ▶ Briefly press [●]. ▶ Keep [▲] or [▼] pressed. > [----] is displayed. ▶ Briefly press [●]. It makes sense to delete the memories as soon as the unit operates under normal operating conditions for the first time.	Menu MEM: [Hi.T] [Lo.T]

9.5.2 Resetting all parameters to factory setting

▶ Select [rES]. ▶ Press [●]. ▶ Press [▲] or [▼] and keep pressed until [----] is displayed. ▶ Briefly press [●]. It is recommended to take down your own settings in the table before carrying out the function → 12 Factory setting.	Menu EF: [rES]

10 Operation

10.1 Reading the process value

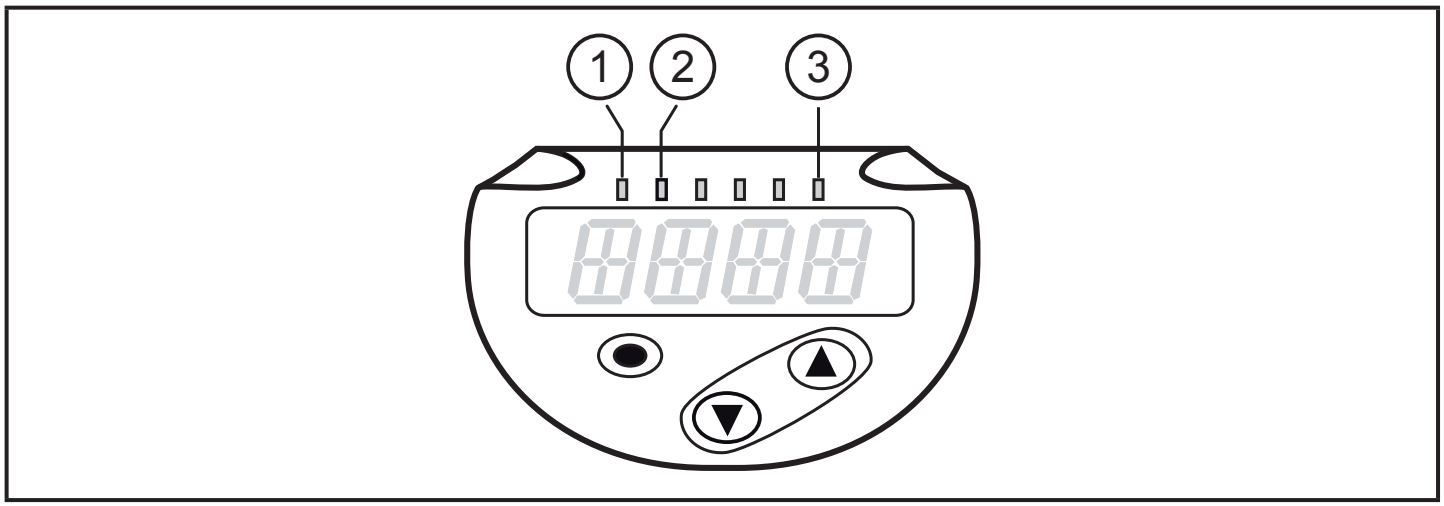
The LEDs 1-3 signal which process value is currently displayed.
The process value to be displayed as standard (temperature or volumetric) can be preset → 9.4.2 Configuration of the standard display. A standard unit of measurement can be defined for the volumetric flow quantity (l/min or m^3/h, for SBN2xx: gpm or gph → 9.4.1).

In RUN mode, further process values can be read in addition to the preset standard display:

▶ Press the buttons [▲] or [▼].

> The LED of the selected process value display is lit and the current process value is displayed.

> After 30 seconds the display changes to the standard display.



LED		Process value display	Unit	Unit SBN2xx
1	▭	Current flow volume per minute	l/min	gpm
2	▭	Current flow volume per hour	m^3 / h	gph
3	▭	Current medium temperature	°C	°F

10.2 Reading the set parameter value

1. Change from the RUN mode to the main menu	[●]
2. Select the requested parameter	[▲] or [▼]
3. Change to the setting mode > The currently set value is displayed for 30 s. By pressing [●] several times, the display switches between parameter and parameter value.	[●]
4. Return to the RUN mode without parameter change	→ 9.1.3

10.3 Error indications / self-diagnostics

	Warning message
[SC1]	Short circuit in OUT1. LED1 for OUT1 flashing (→ 7 Operating and display elements).
[SC2]	Short circuit in OUT2. LED2 for OUT2 flashing (→ 7 Operating and display elements).
[SC]	Short circuit in both outputs. LED1 and LED2 flashing (→ 7 Operating and display elements).
[OL]	Detection zone of volumetric flow or temperature exceeded. Measured value between 120 % and 130 % of the final value of the measuring range.
[UL]	Below the detection zone of temperature. Measured value between -120 % and -130 % of the final value of the measuring range.
[Err]	Unit faulty / malfunction. Measured value greater than 130 % of the final value of the measuring range.
[C.Loc]	Setting pushbuttons locked, parameter change rejected. Active IO-Link communication.
[S.Loc]	Setting pushbuttons locked, parameter change rejected. Unlock using parameter setting software.
[IOE.n]	Malfunctioning. The unit is faulty and must be replaced.

11 Technical data

Technical data and scale drawing at www.ifm.com.

12 Factory setting

Parameter		Factory setting	User setting
SP1 / FH1	(FLOW)	**20 %**	
rP1 / FL1	(FLOW)	**19 %**	
SP1 / FH1	(TEMP)	**12 °C (54 °F)**	
rP1 / FL1	(TEMP)	**11 °C (52 °F)**	
FrP1	(FLOW/TEMP)	**10 %**	
FSP1	(TEMP)	**-10 °C (14 °F)**	
FEP1	(TEMP)	**100 °C (212 °F)**	
FEP1	(FLOW)	**100 %**	
ou1		**Hno**	
SEL1		**FLOW**	
SEL2		**FLOW**	
SELd		**FLOW**	
FOU1		**ou**	
FOU2		**ou**	
uni	(FLOW)	**L/min (gal/min)**	
P-n		**PnP**	
dAP	(FLOW)	**0.1**	
dAA	(FLOW)	**0**	
MEdI		**H2O**	
coLr		**rEd**	
diS		**d2**	

The percentage values refer to the final value of the measuring range.
The values in brackets apply to the SBN2xx designs.

More information at www.ifm.com